

## REMARKS

In view of the above amendments and the following remarks, further examination and reconsideration of the rejections are respectfully requested.

A Notice of Non-Responsive Amendment was issued August 6, 2008, in which it was asserted that claim 34, as amended in the response dated April 30, 2008, is directed to an invention distinct from the invention as originally claimed. In particular, it was asserted that the present embodiment is illustrated in Figures 10-12 while the original claims (as constructively elected) were illustrated in Figures 1-4. However, this is not the case. The Applicants respectfully submit that the response of April 30, 2008, was fully responsive to the Office action of January 11, 2008, for the reasons below.

The original claims 1-33 were directed to a substrate processing apparatus (claims 1-9 and 16-33) and a substrate processing method (claims 10-15). A restriction requirement was issued in the Office action of August 9, 2005, between the claims directed to the apparatus and the claims directed to the method. In the response of September 7, 2005, claims 1-9 and 16-33, directed to the apparatus, were elected; those elected and previously treated claims together read on every one of drawing Figures 1-18. In particular, claims 16-19 read on the drawing Figures depicting an ultrasonic transducer. It is further submitted that all of the currently pending claims also read on the elected invention.

It is further noted that the substance of the amendment of claim 34 in the response of April 30, 2008, was the incorporation of the limitations of formerly depending claims 35 and 39. There is no assertion of record that claims 35 and 39 did not read on a constructively elected species. Furthermore, because the subject matter of amended claim 34 (including that of formerly depending claims 35 and 39) was previously examined and presumably searched by the Examiner, the amendment to claim 34 should provide no undue burden on the Examiner.

A full examination on the merits is thus requested.

In the non-final Office Action mailed January 11, 2008, claims 34, 35, 38, and 41 were rejected under 35 U.S.C. §103(a) as being unpatentable over Wang *et al.* (WO 00/03426) in view of Boyd *et al.* (US 7,264,007). Claim 40 was rejected under 35 U.S.C. §103(a) as being unpatentable over Wang *et al.* in view of Boyd *et al.*, and further in view of Talich (WO

00/26443). Claim 39 was rejected under 35 U.S.C. §103(a) as being unpatentable over Wang *et al.* in view of Boyd *et al.*, and further in view of Colgan *et al.* (US 6,495,005). These rejections are believed inapplicable to the amended claims and the new claims, and the withdrawal of these rejections is respectfully requested for the following reasons.

First, not all the elements of the combination claimed in independent claim 34 are present in the prior art applied by the Examiner: Wang *et al.*, Boyd *et al.*, Talich, and Colgan *et al.* There is no prior art of record that would obviate this shortcoming. In particular, in the Office Action it is stated that “Colgan et al teaches supply and suction ports.... The motivation to modify the design of the supply ports and suction ports... is a matter of design choice....” This assertion is respectfully traversed.

Claim 34 sets forth a processing head with cathodes and anodes, supply ports and suction ports, “...each of said supply ports being in a corresponding one of said cathodes, and with each of said suction ports being in a corresponding one of said anodes ....” The arrangement of the supply ports and suction ports in the present invention is *not* a mere rearrangement of parts in Colgan *et al.*, and it *does* modify the operation of the device. In the present invention, the power source applies a pulse voltage *between the anodes and cathodes* so as to generate microbubbles in the processing liquid. Thus, by pairing the supply ports and the cathodes, it can be ensured that the supply ports correspond to the electrode (cathode) at which the desired gas bubbles are formed. The correspondence of supply ports with cathodes, and suction ports with anodes, is *critical*; it ensures that the microbubbles generated at the cathodes are efficiently delivered to the surface of the substrate due to the flow of the processing liquid from the supply ports. Thus, it is respectfully submitted that the correspondence of supply ports with cathodes and suction ports with anodes is not a mere design choice, but (particularly in combination with the other elements recited in claim 34) is critical to the function of the present invention. This critical correspondence would not have been obvious to a person having ordinary skill in the art at the time the invention was made.

Second, the combination of anodes and cathodes, supply ports and suction ports, and an ultrasonic transducer all on the processing head is not taught in the prior art of record, and this combination of elements produces *unexpected* results.

In particular, conventional substrate processing devices in which bubbles are collapsed by ultrasonic waves of sufficient energy to also generate the bubbles result in cavitation that is

potentially *damaging* to a device being cleaned. In the present invention, a power source able to apply a pulse voltage between anodes and cathodes so as to generate microbubbles produces these very small microbubbles. The microbubbles are then collapsed by applied ultrasonic waves which do *not* produce bubbles themselves. This results in microjets that do *not* damage the device being cleaned (see specification, page 13, lines 6-12, *i.e.*, item iv). Thus, the combination of a power source which may apply a pulse voltage between anodes and cathodes on the processing head so as to generate microbubbles and an ultrasonic transducer on the processing head for emitting ultrasonic waves so as to collapse the microbubbles, and so as to not produce bubbles, together results in an apparatus with effectiveness greater than simply the sum of the two individual elements.

The combination of anodes and cathodes, supply ports and suction ports, and an ultrasonic transducer all on the processing head allows the pairing of supply ports with cathodes on the processing head. This allows generated microbubbles to be efficiently and uniformly distributed over the surface of the substrate. Further, the combination allows application of ultrasonic waves by the ultrasonic transducer on the processing head to the micro-bubbles at the substrate surface, resulting in even wider diffusion of the microbubbles in the processing liquid (see specification, page 12, lines 23-28, *i.e.*, item ii). The microbubbles which collapse result in microjet flows and a high concentration of dissolved gas in the processing liquid. This efficiently cleans the substrate utilizing both the energy of the microjet flows and the chemical properties of the gas (see specification, page 12, lines 14-22, *i.e.*, item i). The microbubbles which do not collapse reflect the ultrasonic waves diffusely, enabling cleaning of finer features than allowed by ultrasonic waves and a processing liquid alone (see specification, page 13, lines 1-5, *i.e.*, item iii).

Thus, the combination of anodes and cathodes, supply ports and suction ports, and an ultrasonic transducer all on the processing head (particularly in combination with the other elements recited in claim 34), produces the unexpected synergy of the present invention. This synergy is nontrivial and would not have been obvious to a person of ordinary skill in the art at the time the invention was made.

Accordingly, it is believed apparent that the combination of features in the present invention as recited in claim 34 are not disclosed or suggested by Wang *et al.*, Boyd *et al.*, Talich, and Colgan *et al.* It is respectfully submitted that there is no disclosure or suggestion in

any of the prior art of record which would have caused a person having ordinary skill in the art to modify Wang *et al.* so as to result in or render obvious the present invention of claim 34. Accordingly, it is believed that claim 34, as well as claims 38, 40, 41, and 54-56 depending therefrom, are clearly allowable over the prior art of record.

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice thereof is earnestly solicited.

If, after reviewing this Amendment, the Examiner feels that there are any issues remaining which must be resolved before the application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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